Methylene Blue Usage in Horseshoe Kidney Graft Separation: Case Report

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Abstract

Definitive diagnostics and strict procedures during kidney donor qualification are required. Nowadays, precise and accurate imaging techniques are at hand for every diagnostician. However, many studies have described intraoperative occurrence of horseshoe kidney. Although the harvesting procedure in the case of horseshoe kidney is not technically difficult, graft separation for successful renal transplantation is a challenge. The complex anatomy of malformed organs causes issues during kidney separation. This procedure may lead to damage of the collecting urinary system as well as vascularization damage. Separate graft transplantation is probable when a thin isthmus in a horseshoe kidney is present. Otherwise, poor graft function may occur. We present a technique for horseshoe kidney separation with the use of methylene blue for vascularization determination. The above-mentioned procedure was performed with the methylene blue solution dose injected into a single renal graft artery. Even with the malformed organ’s thick isthmus, the exact incision line was identified, exposing vascular perfusion asymmetry and allowing precise renal graft separation.

The shortage of organs for transplantation is an everlasting problem in transplantology. For this reason, kidneys with anatomic anomalies should be considered as potential renal grafts, and harvesting techniques should be constantly improved. A horseshoe kidney is an organ malformed during development in the womb, presenting with lower-poles fusion. It is one of the most frequent malformations that surgeons encounter during the harvesting procedure. The malformation may involve only the parenchyma. Quite often, however, the seemingly obvious border separating both organs occurs with complicated vascular remodeling. The above-mentioned anomalies make the decision regarding horseshoe kidney separation very difficult. Other authors report various solutions, such as transplantation en bloc to one recipient. An attempt to separate the fused kidneys is a serious challenge, however, allowing transplantation of two potential renal grafts (Fig 1).

Case Report

A 56-year-old man died of intracranial bleeding after he had spent 6 days in the intensive care unit. Ultrasonography studies revealed no renal malformations, probably as the result of the patient’s obesity. The horseshoe kidney was discovered during the harvesting procedure. The decision was made to continue the procedure because perfusion of the organ was appropriate and no complications occurred. The operation was a multiple organ harvest; the liver was also acquired for transplantation. Because of asymmetry and lack of a definite separation line in the acquired kidney as well as defined single vascularization on each side (Fig 1), the organ was divided and used for transplantation in two recipients. We expected a safe, non-invasive, quick application in the operating theatre without extending the time of the warm ischemia method. All above-mentioned traits eliminated any radiological diagnostic techniques, leaving the use of methylene blue as the only efficient and accurate solution. Methylene blue is an organic chemical compound, commonly used as a pH indicator. Its most important feature is a lack of toxicity for humans.

Because of its wide application in medicine (diagnostic dye, antibacterial substance, in toxicology, treatment of poisoning with cyanide and nitrates), the use of methylene blue seemed to...
be a perfect solution. The dye was infused into one of the arteries supplying the organ, and perfusion was observed instantly. As presented in the figures, a very definite demarcation line was exposed (Fig 2), and the separation procedure was conducted (Fig 3). Harvested organs were transplanted into two recipients, with no complications or technical difficulties during surgery.

The patient who received the renal graft infused with methylene blue achieved immediate graft function. The recipient of the second graft had delayed graft function. Clinical post-transplantation parameters are presented in Fig 4 and Fig 5.

DISCUSSION

Nowadays, when the number of donors remains stable, organs with anatomic anomalies must be taken under consideration for transplantation [1]. Horseshoe kidney remains one of the most common congenital anomalies related to kidneys, with the occurrence of 1 in 600 to 800 [2]. The first successful operation of horseshoe kidney transplantation was described and published by Nelson and Palmer in 1975. Since that time, it is still one of the biggest challenges for surgeons [3]. The horseshoe kidney can be transplanted en bloc to one recipient, or the surgeon may decide to split the organ and perform two transplantations. Complex anatomy of a malformed organ may be the cause of complications after transplantation [4]. After separation, surgeons are advised to make a careful inspection of both kidneys, looking for damage of the collecting urinary system. There are reports suggesting that the intraperitoneal location should be preferred in the case of a horseshoe kidney transplanted en bloc [1]. In each case of horseshoe kidney occurrence, the organ should be harvested en bloc, and subsequent procedures should be performed on the back table [5]. One of the clues suggesting en bloc transplantation is the occurrence of a thick isthmus. However, the surgeon is the one who decides if the separation is possible [3]. There are reports of successful simultaneous pancreas-kidney transplantation with the use of a horseshoe kidney [6]. Merkel [7] describes the successful transplant of a horseshoe kidney harvested from an underaged patient. There are several case reports of successful living donor transplantations of kidneys with horseshoe malformation [8,9]. Stroosma [5] suggests that nowadays it is possible to perform a laparoscopic procedure even in the case of a living organ donor with horseshoe kidney anomaly. Some reports indicate the potential usage of methylene blue in the horseshoe kidney separation process [10]. Application of the technique described above will be possible only in approximately 30% of harvested horseshoe kidneys. It is estimated that in this percentage of horseshoe kidneys, the forming organs have a single vascularization on each side [8]. Complicated anatomy causing difficulties associated with separation often lead to disqualification of the organ; this is why horseshoe kidneys are an underutilized source of organs for transplantation purposes [11]. With this taken into
consideration, each method that increases the use of organs with anomalies is worth developing.

CONCLUSIONS

The use of methylene blue for separation of the horseshoe kidney is safe and efficient. It does not burden the transplanted organs or the recipient organism. In the presented case, separated kidneys perfused with a solution of methylene blue achieved immediate graft function, and its parameters were better than in the non-perfused kidney, which is a serious implication for future research and testing with the above-mentioned method.
REFERENCES


